Health and sustainable behaviours: a pedagogical and didactic experiment in preschool teaching

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Abstract: This pedagogical and didactic experiment comes under the scope of the experimental sciences and it belongs to the environmental education and health field. The methodology used with a group of 15 preschool children was project work, and it took place in a nursery school in the central inland region of Portugal. The research theme was "My behaviour is healthy and environmentally friendly" and its purpose was to foster the understanding of the sustainability vs. health interrelationship. It was designed in three phases: to motivate the discovery by manipulation, to stimulate the desire to seek knowledge and to systematise learning. Children experimented, their curiosity was stimulated, their conceptions were valued and their individual learning paces respected. The results led us to believe that this methodological choice, with these children, was conducive to raising awareness about environmental sustainability behaviours and their relationship to health. In other words, it endorsed a values-based education.

Keywords: preschool children; project work; child motivation; behaviours; sustainability; health.

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1 Introduction: theoretical background and reflection

Environmental education should foster a proactive and participatory citizenship, which is based on a green economy and will ensure the planet's sustainability, in order to mobilise all the exceptional human potential, so that we can overcome the challenges that threaten the combined and peaceful evolution of Man and Earth (Herrero, 2001).

The teacher should observe, plan, document, evaluate and interpret the actions of each child and of the group, integrating the key experiments in the curriculum, aiming to meet the student's interests and needs. He should also facilitate and promote the children's involvement in activities and promote their autonomy. Hohmann and Weikart (2009) refer that adults should be engaged in a child's development and as such, their main goal is to encourage active learning. Thus, the teacher has an important role in structuring a learning environment that provides maximum learning opportunities. The activity nursery school room should be organised in discovery and experimental spaces. It should constitute an open environment, conducive to relationships with others, leading to respect for differences and to the promotion of socialisation, imagination and creativity.

Research in the 1970s showed that if the childhood education (0–6 years) lacks quality, it will have a negative impact on the child's further development. The child should be given the opportunity to ask questions, participate in the planning of activities, investigate and cooperate. The discovery method will let the child have a greater intervention in the learning process as well as a greater confidence in the results of his learning (Raposo, 1997). Learning should be based on problem solving, enhancing the active involvement of children in a process that leads them to discover and build their own knowledge (Arends, 2008).

An education for the development of values, attitudes, environmental ethics and quality of life requires innovative educational strategies that provide meaningful learning. It is essential that the teacher meets the diverse starting points and rates of children's learning, as well as their interests and needs. By valuing their conceptions, the teacher becomes, in this case, the learning facilitator and promoter. In other words, he should contribute to the formation of citizens with lifestyles, habits, values, habits and attitudes that preserve and respect the environment and promote health. The values-based education proposed here is grounded above all on cooperation and coexistence, as well as mutual respect and autonomy, which constitute the foundation for sustainability and healthy behaviours, while respecting individual values.

Project work with children is a methodology proved effective in finding pedagogically appropriate answers. The child is seen as a born researcher (Katz and Chard, 2009). In this pedagogical and didactic experiment, we used this methodology.

The theme developed in the project (based on concrete and defined knowledge), respects the curricular integration inherent to the project's pedagogy. This educational experiment aimed to understand the sustainability vs. health interrelationship, in three phases: to motivate the discovery by manipulating, to stimulate the search for knowledge and to systematise learning.

1.1 Health and sustainability

Individuals should be made aware of the development of sustainable pro-environment actions from an early age (Uzzell et al., 1998), thus ensuring the present needs without compromising the needs of future generations. In this context, within the education field, it is essential that educational institutions, teachers and families invest in a values-based education, and raise society's awareness to correct behaviours and attitudes that undermine sustainability and environmental health. This training allows children to grow with the awareness that the environment must be protected, preserved and recovered because, as Giordan and Souchon (1996) argued, the key is to allow children to understand and be sensitive to the nature of the environmental problems. Considering that, according to Cavaco (1992, p.8), "Environmental Education is the strong point of pedagogical innovation projects, which means that environmental education is one of the most alluring proposals, very up-to-date, and the most interesting". Children's awareness of environmental issues implies innovative teaching practices are sought, which are based on three fundamental pillars, education, environment and health.

Given the current problems of consumer society and all its consequences, whether in the management of environmental sustainability or for the population's health, the education of citizens is a strategic priority. In terms of effectiveness, education is a

process capable of providing citizens with a clear vision of the relationship between production, consumption, environment and health, and simultaneously guide and empower individuals with the knowledge, attitudes and values that enable them to be involved and engaged in finding solutions for the different individual or social challenges, which they should actively undertake. Nowadays it is well known that pedagogy plays a key role in the successful protection of the environment as well as caring for health.

Thus, the challenge of sustainable development involves us all, in the awareness of a free, informed and responsible choice of individual and collective behaviours to adopt. It is necessary that these values reflect civility, respect and solidarity with the current and future generations. Sustainability predicts that the population's growth and the desire for increased economic development do not exceed the levels of environment sustenance (Caeiro, 1998). It is, above all, the achievement of a harmonious relationship between nature and society (Leis, 1999). There must be reciprocity between man and nature. According to Varine (2000, p.62), "failure to comply with this interdependence means environmental imbalance and hence the need for an educational process with pro-environmental and social attitudes". According to Almeida (2003), environment survival and sustainability is understood as the continuity of human endeavours and the planet; it involves planning and executing actions, taking equally into account the economic, the environmental and the social dimension.

Connolly and Prothero (2003) found that individuals understand that being pro-environment is only about having attitudes such as recycling and purchasing environmentally friendly products, without the notion of the importance of reducing consumption levels. Fujii (2006) found that resource-saving behaviours were understood as saving attitudes and not as pro-environmental behaviours.

Environmental Education means promoting environmental literacy, regardless of the group to which it is addressed, and aims to involve citizens in the fundamental issues of environmental quality, which conditions the quality of life of all living beings. The understanding of these phenomena should be action-oriented. By developing action skills, individuals gain autonomy and become resourceful in finding information to change attitudes, in forming opinions that may contradict the dominant ideas and in revealing tolerance and openness to accept the beliefs and opinions of others (Almeida, 2003). Thus, its purpose is not only the development of critical thinking, but also the awareness of environmental issues, in order to lead individuals and communities to actively act on environmental issues and to present solutions to these issues. Pro-environment and healthy behaviours should be learned in practice and started at an early age. According to Antunes (2002), the four pillars of education are: Learning to know, learning to do, learning to live together and learning to be.

Considering the importance of the environment-health relationship, as well as an integrated view of the world, in time and space, the *kindergarten* should provide effective means for every child to understand natural phenomena, healthy habits, human actions and their consequences for other living beings and the environment in general. It is essential that each child develops their potential and adopts personal postures and social construction behaviours, helping to build a sustainable and socially fair society.

There is a need to educate about the environment, in the environment and for the environment. In this perspective, the *kindergarten* must educate for environmental literacy, which means developing educational processes in these three levels.

Some studies referred to by Miranda and Freitas (2001), reveal a close relationship between cognitive and moral development, suggesting that the cognitive components may determine the development of certain attitudes and environmental values. According to Carapeto (1998), active and intervening strategies are those in which the target is not a mere spectator of the intervention of the monitor, but one who acts actively in the process, thus achieving better results in terms of changing attitudes.

It should be noted that preschool students have prior conceptions about the environment and its relationship to health. Their initial representations should be a starting point for developing pedagogical work. It is about understanding the different representations in order to analyse the issues and groups, and only by doing this, can we act effectively. Children have "knowledge schemes which are primary, subjective, inconsistent, not very mature and unable to capture the complexity of the environment" (ME, 2006, p.75). It is necessary that children are offered strategies which foster the transition of common sense to increasingly rigorous scientific knowledge and allow them to think and act in an environmentally conscious manner, which implies transmitting scientific knowledge, developing skills, changing attitudes, behaviours and values from the perspective of an active and responsible citizenship towards the environment.

By implementing the project work methodology for environmental sustainability in nursery school, we are promoting the understanding of environmental problems resulting from human action, as well as responsibility, and the children's critical role as citizens of this global world. Thus, they will develop skills and values that will lead them to rethink and evaluate their everyday actions and their consequences on the environment in which they live. The gradual change of an anthropocentric paradigm, which compromises the natural balance and generates situations of rupture, for a system of eco-centric values, that values respect for all life forms and sees man as an inseparable part of the environment and nature, presupposes a significant change of values and attitudes that lead to the development of a more active environmental awareness (Miranda and Freitas, 2001). Adopting conscious behaviours towards the environment, from which man is an integral element, depends largely on the education acquired since childhood, as well as the family, which has a key role in this process.

Educational environment should "offer the child an active participation in concrete actions in which he has the potential to identify, incorporate and experience values" (Craveiro and Ferreira, 2007, p.18). Given all this, a values-based education is necessary.

Health education is about individual empowerment, that is, it enables citizens to become more involved in the search for well-being, providing them with the ability to make the most appropriate decisions to improve individual and collective health. It is concluded that lifestyle and behaviour are directly related to health. Tones and Tilford (1994, p.11) believe that educating for health "is all intentional activity conducive to learning related to health and disease (…), producing changes in knowledge and understanding and ways of thinking . It may influence or clarify values, it can provide changes in beliefs and attitudes, it can facilitate the acquisition of skills and it may also lead to changes in behaviour and lifestyles". Thus, a close relationship between our life and the environment makes us value the health of the environment as an extension of our own health (Smyth, 1996).

Environmental Education and health assume a multi-level perspective in the educational field, because they are present in all areas of the logic-integrated learning curriculum.

Eating habits are directly related to quality of life. Plants have had a great importance since the dawn of humanity, whether for nourishment or for the use of their medicinal and aromatic properties (Borges and Almeida, 1996). "A safe food is also one that is produced in order to protect the environment" (Instituto Do Consumidor (IC), 2005, p.37).

The child as a social actor is capable of operating changes and to fully contribute to a change in social attitudes, adopting healthy pro-environmental behaviours.

1.2 Environmental education and health values

Environmental and Health Education must intersect with the values being assigned to multiple interpretations of this concept. According to Costa and López (1996, p.96), values represent "emotionally charged beliefs, which individuals and groups in society use to make judgements about the importance and meaning of people, things, behaviours, events and any other socio-cultural object, regarding their ability to meet personal and social needs". Other authors consider values as a set of individual preferences that reflect and influence attitudes and are therefore associated with feelings of approval or disapproval (Downie et al., 2000).

In environmental terms, values are of particular relevance, since environmental issues according to individual interests in the short term, sometimes collide with long-term social interests (Osbaldiston and Sheldon, 2002). Studies have demonstrated the importance of values (within behavioural scope) to promote the well-being of individuals and of all living beings (Milfont et al., 2006).

Education for the environment and health should establish that it is essential to develop and adopt sustainable healthy behaviours. Thus, ethics should be seen as a basic element in the construction of educational programs. Novo (1995) defends that any restructuring of environmental and health education, in terms of conceptual changes and/or methodological abilities, will be successful only if it is accompanied by a values-based education which supports action.

In the perspective of Giordan and Souchon (1997), educational action must support its methodological strategies in explicit values. Only then will children be increasingly aware of problems, their causes, possible conflicts of interests and perspectives, and possible alternatives to consider in making decisions. In this vein, the authors also point out the role of the teacher as a mentor, with the task of explaining reasons for different decisions, the clash of positions and even the discovery of new value systems. They also defend the idea that childhood and adolescence correspond to crucial development stages in the discovery of new values or in changing those that tradition tends to impose.

As far as health is concerned, a health education program must be based on the knowledge of the beliefs and experiments of the community, so that it can successfully accomplish its objectives. The adoption of healthy lifestyles is intrinsic to a process of values clarification, since the acquisition of knowledge by itself does not guarantee that beneficial actions will be performed.

Thus, a values-based education has become in recent times a ubiquitous goal, which lacks a theory of conceptual rigour to support it. In alternative, it should become an education where the concepts retain their significance in reference to the intelligibility of things, so that a values-based education does not oscillate subjectively between ideologies and sensibilities, but it is based on ethics, understood not as a normative matter, but as a methodology based on a self-critical reflection. Lourenço (1998) alludes

to the need of presenting to children and adolescents certain guidelines in terms of values education.

In a values-based education, the teacher, in addition to the child's knowledge, must, as pointed by Marques (1999), value reason, emotions and drive, in order to limit and correct the child, both in his spontaneous desires and in his natural inclinations, influenced and conditioned by family, traditions and customs. Thus, the child learns to respect as well as to be supportive, fair, and confident. He learns to accept others along with accepting norms, dialoguing in the search for coexistence agreements. These virtues can be fundamental to the moral formation of individuals committed to the environment, as well as to a healthy lifestyle.

1.3 Learning and project work

Children are able to autonomously construct meanings through the daily experience of everyday life (Lino, 2007). They are "active agents who construct their own knowledge of the world while transforming their ideas and interactions in intuitive and logical sequences of thought and action" (Hohmann and Weikart, 2009, p.22).

According to Hohmann and Weikart (2009), action learning is a central component of the learning wheel, through which children construct knowledge that helps them make sense of the world. The power of active learning comes from the child's personal initiative. So, in order to follow their intentions, children engage in key experiments. Positive adult/child interactions (based on boosting and encouraging problem-solving in the face of conflict), an enjoyable learning environment for the child (activity room, materials and storage areas are particularly significant), a stable daily routine (particularly in the plan-do-review moment in small and large group) and an evaluation of the child (based on teamwork, in daily illustrative records and daily planning) form the educational framework.

The identification of children's alternative conceptions allows for conceptual change. "The ideas that children and we all possess are acquired as a result of living in the world and trying to make sense of what happens around us. These are called alternative conceptions" (Pereira, 1992, p.64). But,

> "in the teaching/learning of science it is important to identify children's alternative conceptions and determine the necessary connections between what they already know and what we intend to teach them. Thus, in terms of the learning process, significant new information is meaningful only if it can be related in a non-arbitrary and substantive way with previously existing knowledge in the learner's cognitive structure." (Pereira, 1992, p.90)

It is necessary for each individual, "to explain, categorise and organise knowledge to make sense" (Pereira, 1992, p.64).

Concept maps are prepared in order to give an overview of the study topic and thus facilitate understanding of the content interrelationships. These maps should be constructed and explained by the teacher, and the child should already be familiar with the themes, so that they become significant and allow for the integration of knowledge (Moreira, 2010). The theory underlying concept maps is the cognitive learning theory of David Ausube (Valadares and Moreira, 2009).

Educational situations should happen in 'action fields', where children can transform exploration into meaningful learning − children understand the world via discovery and experimentation, because learning happens through action on the objects and interaction with people. The concept of active learning relies on four core pillars: direct action on the objects, action reflection, intrinsic motivation and experimentation spirit. To Hohmann and Weikart (2009, p.5) "through learning by doing – make direct and immediate experiments and glean meaning through reflection – children construct knowledge that helps them make sense of the world". Knowing the world is supported by the "child's natural curiosity and desire to know and understand why" (ME, 2007, p.79). Thus, scientific knowledge must be taught to children through action, which provides the creation of scientific concepts and attitudes and investigative skills. According to preschool education curricular guidelines,

> "the topic 'knowledge about the world' is not intended to promote encyclopaedic knowledge, but to provide meaningful and relevant learning for children, which may not necessarily be related to immediate experience. Even if the child does not dominate the contents entirely, introducing different scientific domains creates an awareness that awakens the curiosity and desire to learn." (ME, 2007, p.85)

However, one must not forget that when the child comes to nursery school, she is the result of the social environment. She carries with her previous experiments and knowledge and "when you start preschool you already know many things about the 'world', you have already built some ideas about (…) the natural world (…)" (ME, 2007, p.79).

Project work should have a pedagogical approach focusing on problems − children ask questions and all should be involved in finding answers. Following the socio-constructivist perspective, knowledge must be generated in social practice and be cultural and historically framed. Thus, the search for problem-solving will enable understanding of the surrounding environment, and will make children always try to learn more.

Project work makes the child a researcher, it enables interdisciplinarity in the sense of knowledge interrelationship, in order to further understand and solve a problem. Knowledge is constructed from holistic approaches. The teachers create problematised conditions, promoting meaningful interactions so that the child's development is done towards exponential learning.

Project work methodology in nursery school is independent of the curricular models adopted by each institution (Katz and Chard, 1997, 2009). The projects promote sustainability and environmental values through interdisciplinarity, building the notion that environmental balance is central to environmental and collective health (Irala et al., 2001).

As mentioned by Sá (1994), the simple observation of experiments or its enactment without intellectual involvement, are not promoters of true learning. Only the conducting of experiments and the handling of materials allow children to better acquire concepts (Quinta et al., 2005), which, being intellectually and affectively grounded, lead to meaningful learning (Roldão, 2004). Through project work, the child constructs his own knowledge through experimentation. Teachers should structure and streamline activities promoting scientific literacy. According to Zabala and Arnau (2007), learning science in preschool enhances personal, interpersonal and social development.

2 Research aim

The overall goals of this educational experiment were to:

- encourage development of scientific attitudes and research habits
- establish relationships between soil, seed, germination and plant
- raise awareness to the importance of the ecological construction of germination small structures, by reusing materials
- understand the importance of these small structures in the relationship between ecological sustainability and health
- understand the importance of behaviours in sustainability and health through the discovery of the connection between the recycling of materials, soil, renewable energy (sun) and aromatic plants.
- explore different techniques of artistic expression in the construction of recreational germination structures
- provide the experience of a democratic environment based on dialogue, sharing, cooperation, and mutual assistance in solidarity.

3 Project overview

Under the Master's degree in Preschool Education and Elementary Education Teaching, a pedagogical and didactic experiment with 15 children (aged 5–6 years) was developed, in a *kindergarten* in the central inland region of Portugal (Table 1).

Table 1 Characterisation of the group of children

Age	*Female*	*Male*	*Total*
5 years old	7	2	9
6 years old	3	3	6

The activities in this pedagogical and didactic experiment belong to the institution's project 'The soil is the skin of the Earth', set at the beginning of the school year by the school cluster the *kindergarten* belongs to. This operation was followed by the conceptual scheme shown in Figure 1.

4 Methodology

Children worked individually but arranged in three groups, in round tables (Figure 2).

When planning the project work, children were asked about what they would like to know and find out about seeds, germination, aromatic plants and food. From this dialogue, the following core questions emerged, which supported the development of the project theme:

- What are the seeds like?
- How do seeds become plants?
- How can I sow all year and, at the same time, protect the environment and health?

Figure 1 Exploration of didactic activities outline

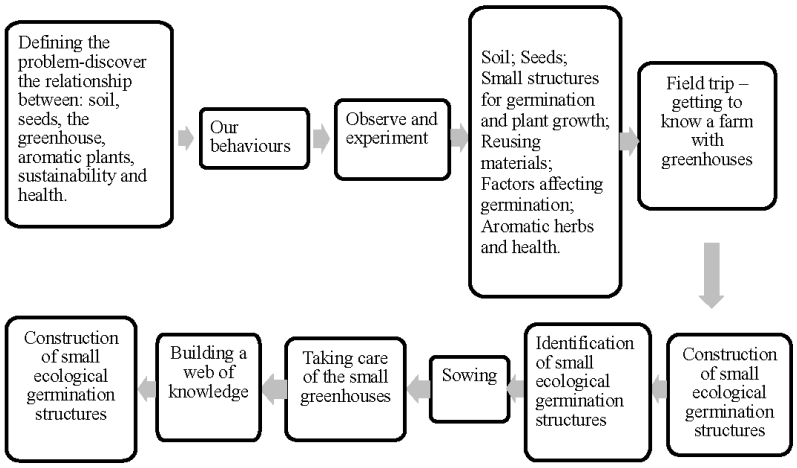


Figure 2 Construction area in the activity room of the nursery school

Thus, exploration of the project's didactic theme "My behaviour is healthy and environmentally friendly" was divided into three phases: motivate the discovery, continue to discover and systematise learning.

i Phase I: Motivating for discovering

Exploration context: The seed-plant relationship.

The audio-visual story 'The Seed' was shown. Then the children were given eight cards with pictures depicting the story and, alternately, each child was given an A3 white sheet with eight rectangles, drawn vertically and an A3 white sheet with rectangles drawn horizontally. Children grasped the concept of space while mentally recounting the story

and then ordering it by gluing the eight cards in the rectangles. This strategy created synergies with the math area and further potentiated autonomy (Figure 3).

Exploration methodology

The sequential steps of the seed-plant relationship exploration:

- show various types of seeds
- question about what distinguishes seeds
- enhance awareness of opinion diversity
- observe and touch different types of seeds
- request that their observations are made clear in each case.

Children record their observations about seed characteristics, with teacher guidance:

Colour (*paint in a similar colour*)	*Size*	*Texture*	*Form*
	Very small	Rough	Round ○
	Small	Smooth	Square □
	Average		Triangle △
	Large		Rectangle ▭
	Very large		

At that point the problematisation was introduced. Children were faced with the following problem questions: How are plants born? What happens when the seed is thrown to the ground?

Children registered, through drawings, their prior conceptions about what would happen to the seed in the soil (Figure 4). By means of dialogue children recall how rich and important the soil is (it should be noted that the content 'Soil Wealth' had been previously discussed).

Figure 3 Recording the story using cutting and pasting

Figure 4 Record of prior conceptions on germination

ii Phase II: continue to discover

Exploration context: The seed-germination-aromatic plant relationship. Children touch, smell and taste.

Exploration methodology

Steps in the exploration of the seed-germination-aromatic plant relationship:

- explore children's prior conceptions about herbs and their usefulness
- strengthen awareness of the diversity of their opinions
- guide children through the recording of their observations.

Afterwards, the following problem questions were posed:

- How do herbs grow?
- How do we sow herbs, all year round, in our homes, if we do not have a back yard and if it is winter?

Children express their conceptions. They express their appreciation for the experiments that allow us to observe the seeds becoming plants.

This is followed by the construction-manipulation step, designated as experiment.

Experiment

- *Observation*

Contacting with greenhouses and recognising their importance was done through a field trip to a city council farm near the nursery school. Thus, it was possible to observe the usefulness of greenhouses and what principles underlie their construction. Emphasis was placed on the importance of temperature for the germination to occur faster than outdoors (without a greenhouse). A child inside the greenhouse made this assertion "Oh it's hot in here; it is why seedlings grow from seeds".

After the field trip, we talked with the children about what they saw and learned.

Here are some examples of some of the children's conceptions: "The day was very important, I'll never forget it". "The greenhouses help the seeds grow plants even when it's cold".

Iconographic records of what was learned with the field trip to the farm were made. Learning was disclosed through the paintings and drawings that the children created. They used the available materials, such as pencil crayons, wax crayons and felt pens.

Through these creations, it became evident that the children learned about the seed-greenhouse-plant relationship.

- *Implementation*

Children will now find the relationship between seed-small-greenhouses-aromatic herbs.

➢ Preparation phase for the construction of small greenhouses.

Our group of children was divided by two tables.

The following material was distributed: plastic box ($30 \times 15 \times 5$) drilled in the base; wire rods (30 cm) that were lined with tissue and would provide support for the ceiling; tape; clear plastic cover; clothes pegs to close the greenhouse; soil; water spray bottle; seeds.

Children were made aware that, whenever possible, we should recycle waste, for example in structures like these. We explained how these small germination structures would be built and asked every child to draw how they thought their small greenhouse would look like (Figure 5).

Figure 5 Record of germination structure idealised by the child

➢ *Germination structure construction phase*

In each construction stage, the child is repeatedly made aware of its usefulness and simultaneously of the importance of eco-preservation. The children note that aromatic plants are important for healthy eating habits, for example, they can replace or reduce salt.

In the end, we designed a collective record of the materials used in the construction of the small greenhouses.

The identification of each child's small greenhouse (Figures 6 and 7) was made by means of colourful scarecrows made of recycled material.

The construction of the small greenhouses was followed by sowing.

➢ *Sowing phase*

Children put the soil in the small greenhouses, followed by sowing and watering. They concluded that the small greenhouses should be in a warm, sunny place. All small greenhouses were placed next to the activity room windows.

- *Germination phase*

A few days later, a child saw the beginning of the germination process, and enthusiastically called the other classmates to observe it. The children followed the germination evolution (Figure 8) and took care of their small greenhouses (Figure 9).

Figure 6 The finished germination structure

Figure 7 Examples of scarecrows

Figure 8 Germination observation

Figure 9 A child watering the soil

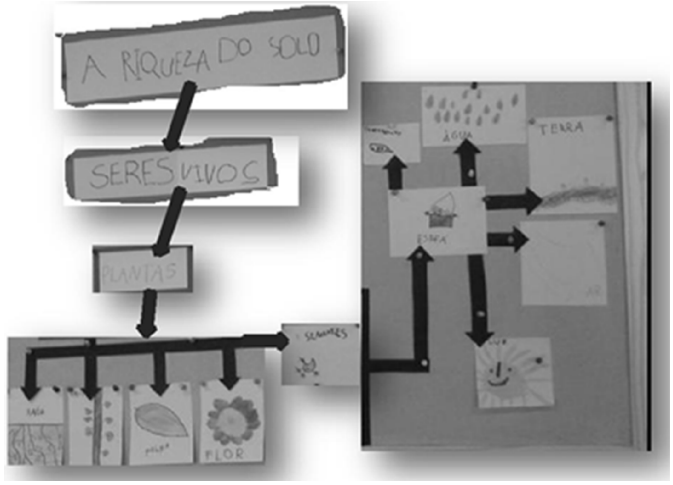
They made a daily record in a calendar with the symbol of the planting time (thus marking the day), as well as the symbols (watering and germination) depending on the action taken in the small greenhouse (Figure 10).

Figure 10 Record of the action carried out in the small greenhouse

iii Phase III: Learning systematisation

Children built a web of knowledge where they recorded everything they found about the soil-plant-seed-germination (Figure 11). This web enabled them to confront the knowledge gained from the initial conceptions, i.e., allowing the children to see what they knew before, what they learned and what they thought was true and it was not.

Figure 11 The web of knowledge about the relationship soil-plant-seed-germination



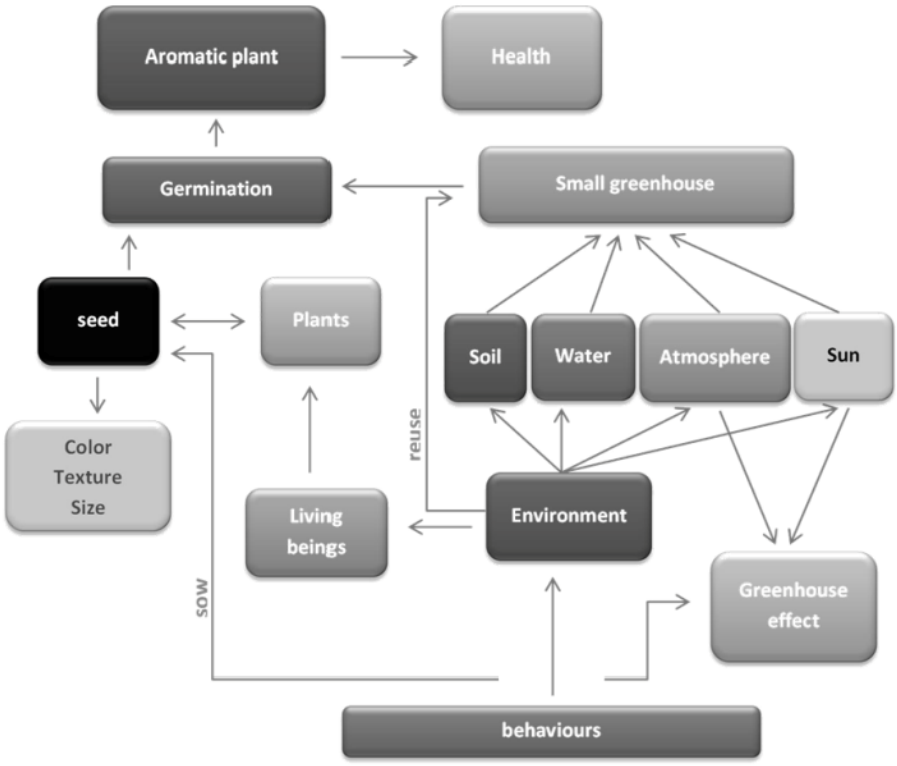
(1) "The wealth of soil"; (2) 'Living things'; (3) 'Plants'; (4) 'Root'; (5) 'Fruits'; (6) 'Leaf'; (7) 'Flower'; (8) 'Seeds'; (9) 'Temperature'; (10) 'Water'; (11) 'Soil'; (12) 'Air'; (13) 'Sun'; (14) 'greenhouse'.

Finally, the class concluded the following, through the exploration of the conceptual scheme of Figure 12 (inter-relationship between sustainability and health):

- Soil is very important for living beings and we should protect it.
- Plants are fundamental living things in nature.
- Soil and water allow the seed to germinate.
- Seeds need sun, soil and water to germinate. But you also need to ventilate the greenhouse.
- The sun provides solar power.
- Greenhouses help retain heat from the sun, which we call the greenhouse effect.
- Small greenhouses warm the air and soil and thus help the seeds to germinate.
- The Earth's atmosphere also acts as a greenhouse, which conserves a temperature suitable to life on our planet.
- An excessive greenhouse effect causes high temperatures which destroy living beings.
- The greenhouse needs daily care (air and water) so that seed germination occurs.
- Germination factors are related to climate and soil.
- Our homes may have small ecological greenhouses, so that there are always aromatic plants for our food.
- The seeds are not all alike, but all germinate seedlings.
- The seed is 'food' for the birth of the little plant.

- We can all build small greenhouses in our homes by recycling materials.
- Recycling materials prevents over-depletion of resources and environmental pollution.
- Nature is not an endless source of resources, therefore waste should be avoided and materials should be recycled.

Figure 12 Conceptual map on "our behaviours are healthy and environmentally-friendly"



5 Conclusion and discussion

Preschool children are extremely curious and have a strong desire to discover and understand their surrounding environment. For children, the near environment and its natural phenomena are therefore cause for awe. The activities were designed so as to arouse curiosity and enthusiasm for the natural environment since "curiosity is the starting point for learning" (Herman et al., 1992, p.3). Cornell says (1996, p.5), "children understand better and commit better to memory the concepts they learn through direct, personal experiment".

Viewing the seed germination story was the context that triggered this pedagogical and didactic experiment, in which learning activities were performed in an integrated manner, which led to focusing on the areas of World Knowledge and Artistic Expression.

The various practical activities originated from motivating contexts and their conceptions, so that children could arrive at conclusions and solutions to problems, encouraging participation, reflection and collaboration as well as acceptance of responsibility, of values and of new attitudes, which led to changing behaviours. The shift to scientific knowledge is facilitated by knowledge of prior conceptions and record-keeping is vital as it stores prior memories.

According to Martins et al. (2009, p.28), "when conceptual change occurs, and is consolidated in the process, the child becomes aware of what she originally thought and the reason why these ideas are confirmed or not". This conceptual change occurs when the child relates what she learned from the "existing ideas in cognitive structure (…) this is the key to learning" (Ontoria et al., 2005, p.14).

Through ongoing dialogue in large groups, knowledge of previous conceptions and trial records, it was possible to transmit scientific knowledge and drive the children to understand the importance of their behaviours for the protection of the environment and their health. According to Hohmann and Weikart (2009, p.7)

> "we recognise that the power to learn resides in the child, hence the focus on practical learning through action. When we accept that learning comes from within, we have reached a critical balance in educating children. The adult role is to support and guide children through the adventures and experiments that integrate learning by doing."

Fumagalli (1998) reveals the importance of social science education at early ages.

In this context, this pedagogical and didactic experiment was rooted in project work, it promoted environmental literacy through contextualised and integrated active learning, expanding the child's intellectual development through the ability to imagine, prevent, explain and question the surrounding environment, leading to behaviour self-regulation.

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